

A Revision of the Genus *Kallima* DOUBLEDAY (Lepidoptera, Nymphalidae)

I. Generic Classification

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Introduction

The genus *Kallima* DOUBLEDAY, 1849* belonging to the family Nymphalidae has been known to comprise about 11 species which are distributed in Asia (about 7 species**; *K. paralekta* (HORSFIELD, 1829), *K. inachus* (DOYÈRE, 1840), *K. horsfieldi* (KOLLAR, 1844), *K. albofasciata* MOORE, 1877, *K. limborgii* MOORE, 1878, *K. alompra* MOORE, 1879 and *K. spiridiva* G. SMITH, 1885) and in tropical Africa (*K. ansorgei* ROTHSCILD, 1899, *K. cymodoce* (CRAMER, 1777), *K. jacksoni* SHARPE, 1896, and *K. rumia* (DOUBLEDAY, 1849)*). So far as we are aware no previous author doubted the congenerousness of these species except for D'ABRERA (1980) who suspected the homogeneity of the genus *Kallima*. He wrote "I doubt very much whether the generic name *Kallima* could be applied to the following Afrotropical species. They have little in common, structurally and behaviourally, with the Oriental species known by this name." However, he still treated the Afrotropical species as congeners of the Asian *Kallima* species.

Most of the previous authors used exclusively the wing characters such as shape, color pattern and venation to define the genus *Kallima*. Some authors, however, examined the male external genitalia in some Asian species and pointed out the importance of genitalic characters in the taxonomy of the genus *Kallima* (FRUHSTORFER, 1912; ROEPKE, 1938; SHIRÔZU, 1960; CORBET & PENDLEBURY, 1978).

* Although in some of recent books "DOUBLEDAY, 1850" and "WESTWOOD, 1850" were adopted as authors and dates of publication of the genus *Kallima* and *K. rumia*, respectively (D'ABRERA, 1980; CARCASON, 1981), we follow SCUDDER (1875) and HEMMING (1967) in this context.

** We can not enumerate the Asian species correctly in the present time, because some confusion have existed in the taxonomy of the Asian species included in this genus. For example, *limborgii* MOORE was treated as a good species (FRUHSTORFER, 1912; MARSHALL & NICÉVILLE, 1886), as a synonym of *inachus* DOYÈRE (BINGHAM, 1905), as a subspecies of *inachus* DOYÈRE (EVANS, 1932) or as a subspecies of *paralekta* HORSFIELD (MORISHITA, 1977).

In order to get more information about male and female external genitalia and wing venation we examined all the known species of the genus *Kallima* except for female of *albofasciata*. Based on the comparative morphology of these structures we came to the conclusion that the genus *Kallima* was apparently polyphyletic, including 4 groups which can be regarded as to be different from each other in the generic level.

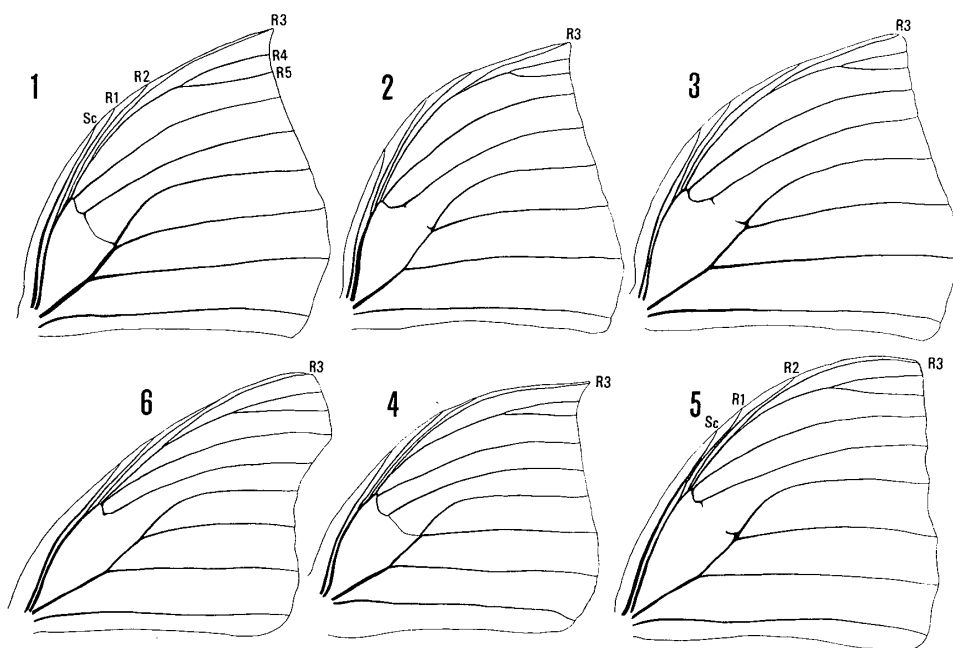
In the present paper we discuss the systematic position of each species hitherto included in the genus *Kallima*.

Morphological Diversity in the Wing Venation and External Genitalia

The genus *Kallima* shows a wide divergence in the wing venation and in the structure of male and female genitalia. The main structural differences are as follows*.

Wing venation

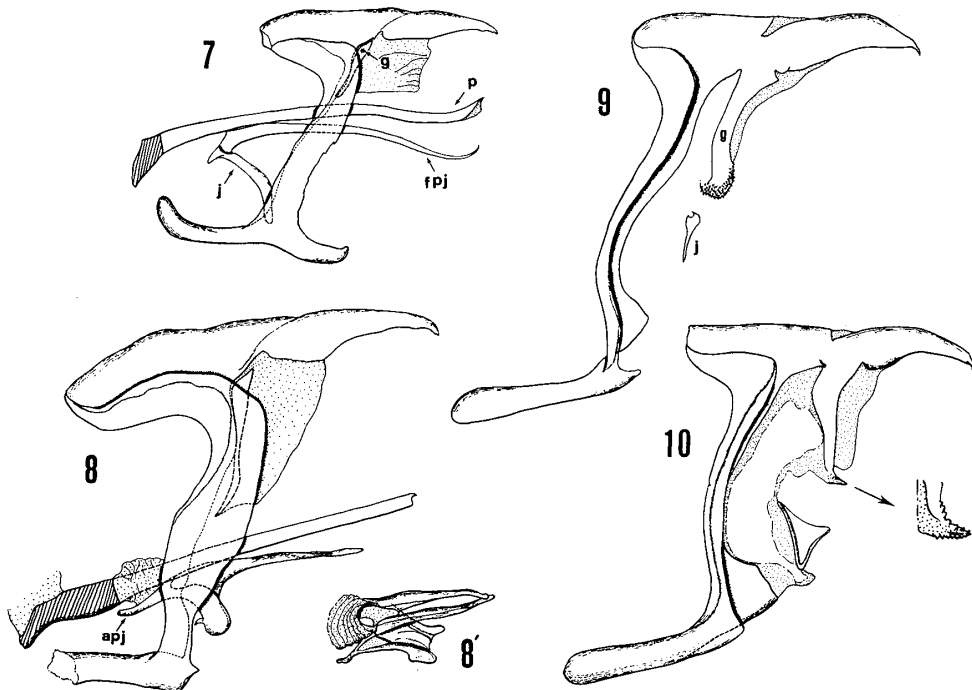
R1. The vein R1 originates at about distal 1/3 of the vein of the anterior margin of the discoidal cell in all the Asian species (Fig. 1), near the upper angle of the cell in *ansorgei*, *cymodoce* and *jacksoni* (Figs. 2–4).



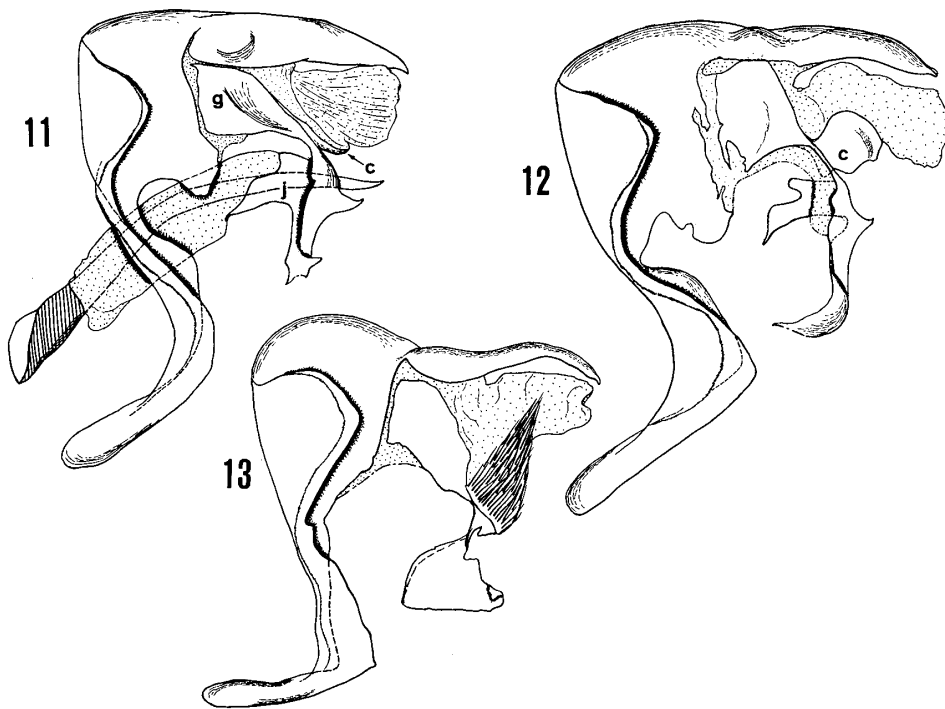
Figs. 1–6. Fore wing venation of *Kallima* spp. and *Junonia evarete*. 1: *K. paralekta* (HORSFIELD). 2: *K. ansorgei* ROTHSCILD. 3: *K. cymodoce* (CRAMER). 4: *K. jacksoni* SHARPE. 5: *K. rumia* (DOUBLEDAY). 6: *J. evarete* (CRAMER).

R3. The vein R3 originates at about proximal 1/5–1/4 of the vein between the upper angle of the cell and the point of origin of R4 in all the Asian species and *jacksoni* (Figs. 1, 4), near or beyond the middle of the vein in *ansorgei* and *cymodoce* (Figs. 2–3).

* *K. rumia* is utterly different from the other species of *Kallima* in every respect. This species is excluded from this section and will be described in detail in the last section of this paper.



Figs. 7-10. Male external genitalia of *Kallima* spp. and *Catacroptera cloanthe*. 7: *K. paralekta* (HORSFIELD), ring, gnathos, juxta and phallus in lateral view. 8: *K. alompra* MOORE, ditto; 8', juxta in posterodorsal view. 9: *K. jacksoni* SHARPE, ring, gnathos and juxta in lateral view. 10: *C. cloanthe* (STOLL), ditto. apj, apodemal process of juxta; fpj, free process of juxta; g, gnathos; j, juxta; p, phallus.



Figs. 11-13. Male external genitalia of *Kallima* spp. and *Junonia evarete*. 11: *K. ansorgei* ROTHCHILD, ring, gnathos, juxta and phallus in lateral view. 12: *K. cymodoce* (CRAMER), ring, gnathos and juxta in lateral view. 13: *J. evarete* (CRAMER), ditto. c, cochlear.

Ldc of fore wing. The vein ldc is present though it is very thin and nontubular in all the Asian species and *jacksoni*, mostly disappearing except the anterior and posterior rudiments in *ansorgei* and *cymodoce*.

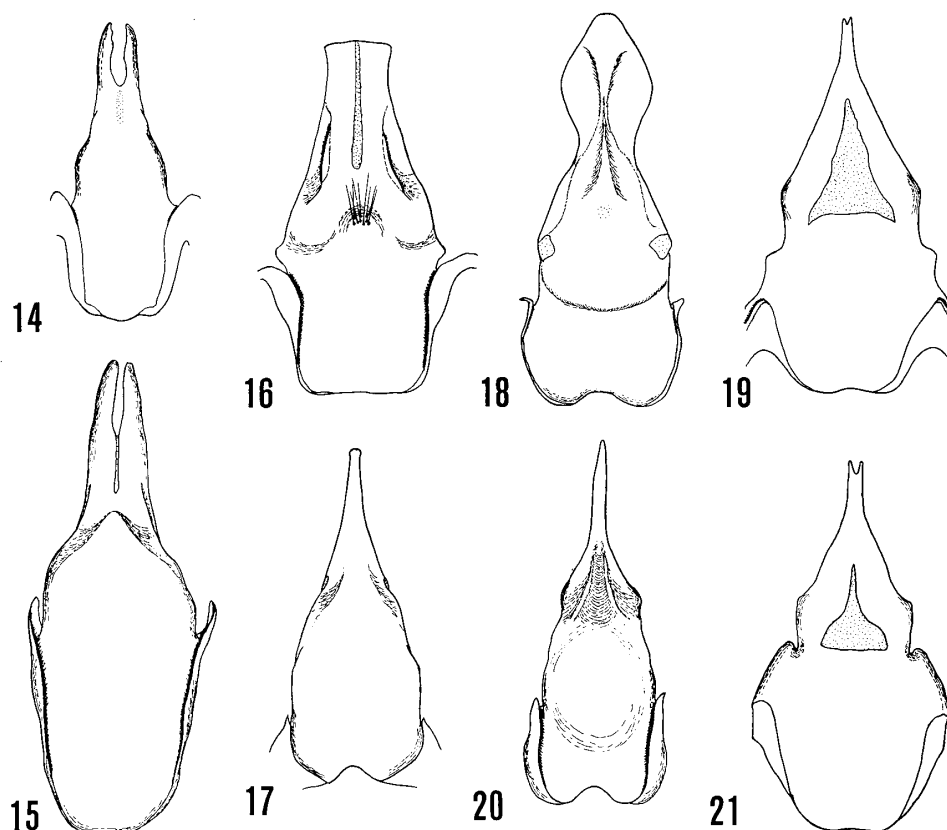
Ldc of hind wing. The vein ldc is present though it is very thin and nontubular in all the Asian species, completely absent in *ansorgei*, *cymodoce* and *jacksoni*.

Male external genitalia

Tegumen. The dorsal part of tegumen protrudes anteriorly in various degrees so that the tegumen in lateral view is nearly triangular in all the Asian species and *jacksoni* (Figs. 7–9). The dorsal part does not protrude and the tegumen in lateral view nearly rectangular in *ansorgei* and *cymodoce* (Figs. 11–12).

Uncus. The uncus is much tapered and emarginated at extreme tip and bears a large triangular membranous area, fenestrula, in *jacksoni* (Fig. 19); rather broad and deeply bifurcated apically and lacks a prominent fenestrula in all the Asian species (Figs. 14–15) except for *horsfieldi* in which a long median membranous slit is present (Fig. 16); very slender with a blunt apex in *ansorgei* (Fig. 17); broad and expanded laterally before the apex giving a spatulate appearance in *cymodoce* (Fig. 18).

Gnathos. The gnathos is semiannular, dorsally completely fused with ventral

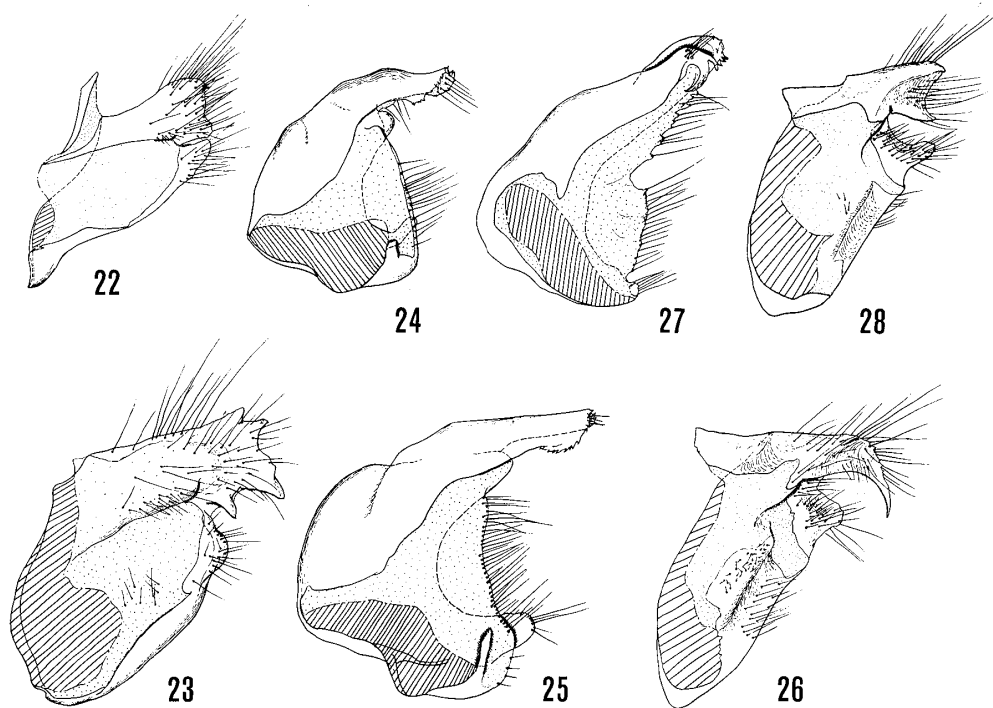


Figs. 14–21. Dorsa of *Kallima* spp., *Junonia evarete* and *Catacroptera cloanthe* in dorsal view. 14: *K. paralekta* (HORSFIELD). 15: *K. alompra* MOORE. 16: *K. horsfieldi* (KOLLAR). 17: *K. ansorgei* ROTHCHILD. 18: *K. cymodoce* (CRAMER). 19: *K. jacksoni* SHARPE. 20: *J. evarete* (CRAMER). 21: *C. cloanthe* (STOLL).

margin of the dorsum and its ventral portion is somewhat membranous, beset with many minute spines in *jacksoni* (Fig. 9). In *ansorgei* and *cymodoce* the gnathos is also semiannular but separated from the dorsum, very wide at basal portion and becoming very narrow toward ventrodistally, with well developed cochlear, and the sides of the ventrodistal portion extend ventrads toward the juxta and fused with it (Figs. 11–12). In all the Asian species the gnathos is reduced into a pair of slender sclerites which are situated close to the posterior margin of the ring (Figs. 7–8).

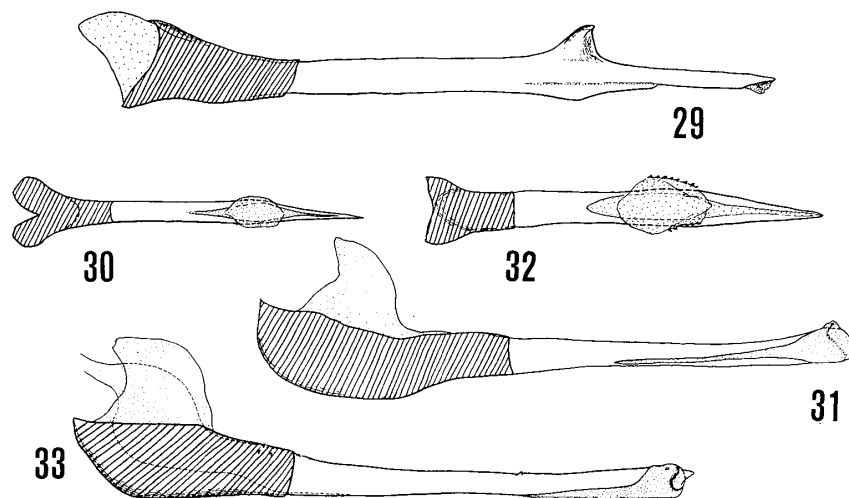
Juxta. In *alompra* and *horsfieldi* the juxta is plate-like sclerite, from the dorsal portion of which two pairs of processes are developed, one extending forwards (apodemal processes) and the other extending backwards (free processes) (Fig. 8). In the other Asian species the juxta is slender and club-like situated on the midventral line of the diaphragma, the dorsal part of juxta projects paired extraordinarily long free processes backwards and a pair of very short apodemal processes forwards (Fig. 7). In *ansorgei* and *cymodoce* the juxta is a short tubular structure situated horizontally, from the posterior end of which a pair of vertically extending sclerites arise and they fused with gnathos dorsally and sacculi ventrally (Figs. 11–12).

Valva. In all the Asian species the valva is rather simple and weakly bilobate apically; the upper lobe (ampulla) is somewhat expanded with the apical margin usually truncated and shallowly emarginated (Fig. 22), (in *horsfieldi* the upper lobe has 4 large dentiform projections at the apical margin (Fig. 23)), the lower lobe (harpe) is small with the apex rounded; the ventroproximal portion of the costa extends forward and



Figs. 22–28. Insides of right valvae of *Kallima* spp., *Junonia evarete* and *Catacroptera cloanthe*. 22: *K. paralekta* (HORSFIELD). 23: *K. horsfieldi* (KOLLAR). 24: *K. ansorgei* ROTHSCILD. 25: *K. cymodoce* (CRAMER). 26: *K. jacksoni* SHARPE. 27: *J. evarete* (CRAMER). 28: *C. cloanthe* (STOLL).

usually exceeds the anterior margin of the outer wall of the valva. In *ansorgei* and *cymodoce* the valva is short and very broad basally (Figs. 24–25); the ampulla is elongated posteriorly with its apical portion weakly twisted inwardly and its distal margin distinctly serrate; the harpe is broadly and deeply emarginated distally so that the most part of the harpe is concealed under the anellifer seen from the inner side; the sacculus is narrow and extends towards the juxta and fused with it. In *jacksoni* the valva is rather small (Fig. 26); the ampulla extends backwards and strongly downcurves with a sharply pointed apex; the costa is broad and extends proximally; the harpe is small; the sacculus is rather large, without any extension towards juxta.



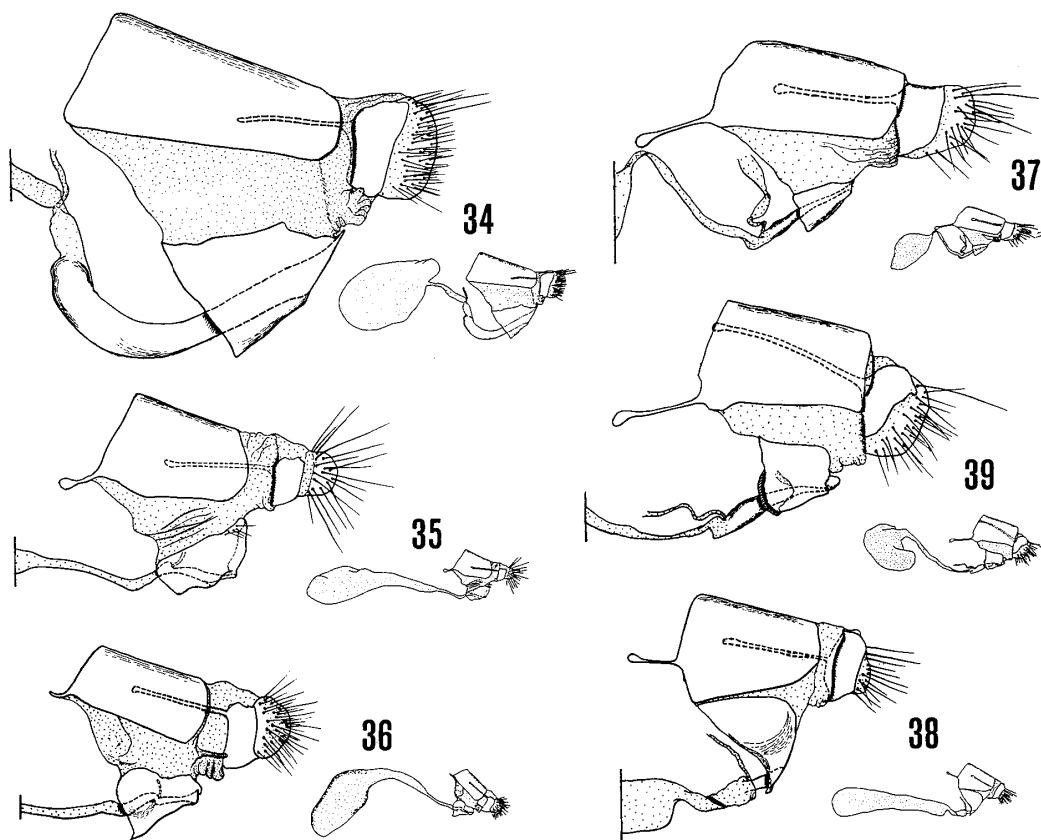
Figs. 29–33. Phalli of *Kallima* spp., *Junonia evarete* and *Catacroptera cloanthe*. 29: *K. horsfieldi* (KOLLAR), lateral view. 30: *K. ansorgei* ROTHSCILD, ventral view. 31: *K. jacksoni* SHARPE, lateral view. 32: *J. evarete* (CRAMER), ventral view. 33: *C. cloanthe* (STOLL), lateral view.

Phallus. In all the Asian species the phallus is very to extraordinarily long, at least longer than the height of ring, the subzonal sheath is very short, usually $0.1 \times$ as long as the entire length of phallus (in *horsfieldi* $0.29 \times$, and in *alompra* $0.25 \times$) (Figs. 7–8, 29), the perivesical area is present on the ventral surface from apex to apical 0.2 – 0.4 . In *ansorgei* and *cymodoce* the phallus is short, less than the height of ring, the subzonal sheath is 0.26 – $0.29 \times$ as long as the entire length of phallus (Figs. 11, 30), the perivesical area is present on the ventral surface of apical half. In *jacksoni* (Fig. 31) the phallus is long, more than the height of ring, and the subzonal sheath is also long, $0.42 \times$ the length of entire phallus; asymmetrically sclerotized apically so that the perivesical area is situated on the left side on apical 0.4 of phallus.

Female external genitalia

Apophysis anterioris. The apophysis anterioris is absent in all the Asian species (Fig. 34), while present in the Afrotropical *ansorgei*, *cymodoce* and *jacksoni*; short and at most $0.2 \times$ as long as the 8th tergum in *ansorgei* and *cymodoce* (Figs. 35–36), long and $0.4 \times$ as long as the 8th tergum in *jacksoni* (Fig. 37).

Apophysis posterioris. The apophysis posterioris is long and slender, about half



Figs. 34-39. Female external genitalia of *Kallima* spp., *Junonia evarete* and *Catacroptera cloanthe* in lateral view. 34: *K. paralekta* (HORSFIELD). 35: *K. ansorgei* ROTHSCILD. 36: *K. cymodoce* (CRAMER). 37: *K. jacksoni* SHARPE. 38: *J. evarete* (CRAMER). 39: *C. cloanthe* (STOLL)

as long as the 8th tergum in all the Asian species. In *ansorgei*, *cymodoce* and *jacksoni* the apophysis posterioris is very long, about $0.7-0.8\times$ as long as the 8th tergum.

Ductus bursae. The sclerotized part of ductus bursae (antrum) is very short, less than the length of genital plate in *ansorgei* and *cymodoce* (Figs. 35-36), moderately long, more than the length of genital plate in *jacksoni* (Fig. 37), *alompra* and *horsfieldi*, or very long, at least $2\times$ as long as the genital plate in the remaining Asian species (Fig. 34).

Corpus bursae. The corpus bursae is bulbous in all the Asian species and *jacksoni*, narrow and elongate in *ansorgei* and *cymodoce*.

Discussion

1) *The main apomorphies*

As described above in the wing venation and in the external genitalia there exist considerably wide ranges of character states for many features in the genus *Kallima*. Concerning most of these features we may infer their most apomorphic states as follows. These states are inferred to be apomorphic because they are found only in the restricted

genera or species within the subfamily Nymphalinae*.

- 1) Apex of uncus deeply bifurcated.
- 2) Uncus with a developed fenestrula.
- 3) Gnathos reduced into a pair of slender sclerites that extend proximally on deep manica.
- 4) Cochlear well developed.
- 5) Gnathos beset with minute spines on ventral portion.
- 6) Gnathos, juxta and sacculus constructed a complex composite together.
- 7) A pair of long free processes projected backwardly from the dorsal part of juxta.
- 8) Harpe deeply and broadly emarginated on its distal margin.
- 9) Phallus asymmetrically sclerotized on suprazonal sheath with peri-vesical area on left side.

2) Systematic position of each species

The above mentioned apomorphies are found in the *Kallima* species other than *rumia* as follows:

	apomorphy								
	1	2	3	4	5	6	7	8	9
<i>ansorgei</i>				+		+		+	
<i>cymodoce</i>				+		+		+	
<i>jacksoni</i>		+			+				+
<i>paralekta</i>	+		+				+		
<i>spiridiva</i>	+		+				+		
<i>inachus</i>	+		+				+		
<i>albofasciata</i>	+		+				+		
<i>limborgii</i>	+		+				+		
<i>alompra</i>	+		+				+		
<i>horsfieldi</i>			+				+		

Based on the common possession of the apomorphies we can recognize three groups; *ansorgei* + *cymodoce*, *jacksoni*, and Asian species groups.

Asian species. Although there are several conspicuous morphological differences between *alompra* + *horsfieldi* and other Asian species in the structures of juxta, phallus and ductus bursae, they share two peculiar apomorphies, i.e. apomorphies 3 and 7. These character states are found only in all the Asian species of *Kallima* within the subfamily Nymphalinae, and they may safely be considered to be synapomorphies of these species. Moreover members of this group, with the exception of *horsfieldi*, have deeply bifurcated uncus (apomorphy 1). The uncus of *horsfieldi* differs from those of other Asian species, but the character states of *horsfieldi* uncus can be regarded as a more plesiomorphic state in the transformation series from the simple beak-like uncus

* We use Nymphalinae in the sense of SHIRÔZU (1960) and this corresponds to Vanessinae of AURIVILLIUS (1913) or Nymphalini of VAN SON (1979) and CARCASSON (1981).

to the deeply bifurcated one.

Thus the Asian species have three peculiar synapomorphies, and they may be grouped in a distinct monophyletic group. This group contains the type-species of the genus *Kallima*, *paralekta*, therefore all the Asian species should be included in the genus *Kallima*.

Ansoergei and *cymodoce*. AURIVILLIUS (1913) divided the Afrotropical *Kallima* into the *rumia*+*jacksoni*- and the *ansorgei*+*cymodoce*-group based mainly on the hindwing shape; in the former group hindwing is 'broad and rounded and with the distal margin undulate,' and in the latter group it is 'elongated from costal margin posteriorly with the distal margin entire.' We came to the same conclusion concerning to combine *ansorgei* and *cymodoce* as AURIVILLIUS did.

These two species are somewhat different from each other in the shape of the uncus, but they have three peculiar apomorphies in common, namely apomorphies 4, 6 and 8. Adding to these apomorphies male of *ansorgei* has the acute beak-like uncus, and females of *ansorgei* and *cymodoce* have very long apophyses posteriores and narrow and elongate corpus bursae. These character states are found throughout the genus *Junonia* HÜBNER* (cf. Figs. 6, 13, 20, 27, 32 and 38).

Based on these data, we may conclude that *ansorgei* and *cymodoce* belong to *Junonia*, notwithstanding they have peculiarly colored and shaped wings, and lack a pair of serrate sclerites on the perivesical area of the phallus. The peculiarly shaped uncus in *cymodoce* may be secondary specialization attained by this species.

Jacksoni. This species has simpler male genitalia compared with the above mentioned two groups. However, this species has three apomorphies of its own, apomorphies 2, 5 and 9. Moreover this species has several characteristic features as follows: Gnathos dorsally completely fused with ventral part of dorsum; uncus very narrow, with a shallow emargination at extreme tip; juxta simple, V-shaped; costa of valva rather broad and extending forwards with its proximal end very close to the dorso-proximal portion of gnathos; apophysis anterioris long; R3 arising at about basal 1/5 of the vein between upper angle of the cell and origin of R4.

All the character states in the wing and the external genitalia in *jacksoni* just mentioned above are found also in the genus *Catacroptera* KARSCH, 1894, which hitherto has been known to comprise single species, *cloanthe* (STOLL), as shown in Figs. 10, 21, 28, 33 and 39 (for wing venation see Fig. 6 of VAN SON, 1979). These two species are so different from each other in the wing shape and especially in the wing coloration that no one has inferred the close phylogenetic relationship between them. However, they have such peculiar characters including several apomorphies only common to them that their belonging to the same genus can hardly be doubted. *Kallima jacksoni* should be transferred to the genus *Catacroptera*.

Rumia. *Rumia* is treated in the next section.

* We follow DE LESSE (1952) and use *Junonia* as a good genus. The type-species of *Junonia* is *evarete* (CRAMER).

Conclusion

1. The genus *Kallima* is applicable only to the Asian species, and the generic characters are as follows.

Wing venation: R1 originating at about distal 1/3 of anterior marginal vein of the discoidal cell. R3 arising at about proximal 1/5–1/4 of the vein between upper angle of the cell and origin of R4. Cells of fore and hind wings closed by very thin and nontubular vein.

Male genitalia: Dorsum strongly expanded forward, rather narrow in width, becoming narrower towards apex beyond proximal 1/3, without fenestrula; uncus deeply bifurcated and weakly curved downward at apex except in *horsfieldi*, in which a long median longitudinal membranous slit separates uncus into a pair of lateral sclerites. Ring with a very broad reflected flange, the posterior margin of which far surpassing that of the ring except in *horsfieldi*, in which the posterior margin of the flange not surpassing that of the ring. Gnathos strongly reduced into a pair of slender sclerites situated close to the posterior margin of tegumen, and usually extending forwards on deep manica surpassing the ring. Valva rather small and simple, weakly bilobate apically, ventral lobe rounded and half as broad as dorsal lobe; outer wall evenly sclerotized, inner wall divided into costa + ampulla, sacculus + harpe and broad anellifer; ventroproximal part of costa usually extended forward exceeding the anterior margin of the outer wall of valva, apical margin of ampulla truncated and weakly emarginated except in *horsfieldi* in which it is not emarginated but with 4 large dentiform projections. In the structure of juxta there are two types. The first type is found in the species other than *horsfieldi* and *alompra*; juxta slender and club-like situating on the midventral line of diaphragma, its ventral end very close to dorsal margin of saccus, from dorsal end of juxta paired extraordinarily long free processes projecting backwards, with a pair of very short apodemal processes. The second type is found in *horsfieldi* and *alompra*; juxta plate-like, developing a pair of long apodemal processes adding to paired backwardly extending free processes that are not extraordinarily long as seen in the first type. Phallus very to extraordinarily long, straight, or weakly sinuate, or sickle-shaped, and without carina penis except in *horsfieldi* in which very strong carina penis is formed at apical 1/3; subzonal sheath very short or moderately long, about 0.1–0.29 × as long as the entire length of phallus.

Female genitalia: Genital plate well developed, simple. Ostium bursae on genital plate. Sclerotized part of ductus bursae (antrum) various in length, but at least 1.5 × as long as genital plate. Corpus bursae large and burbous, lacking signum. Apophyses anteriores absent. Apophyses posteriores long and slender, about half as long as 8th tergum.

2. *Ansongei* and *cymodoce* are transferred to the genus *Junonia* HÜBNER.

Junonia ansongei (ROTHSCHILD, 1899), **comb. nov.**

Kallima ansongei ROTHSCCHILD, 1899.

Junonia cymodoce (CRAMER, 1777), **comb. nov.**

Papilio cymodoce CRAMER, 1777.

Kallima cymodoce: DOUBLEDAY, 1849.

3. *Jacksoni* is transferred to the genus *Catacroptera* KARSCH

Catacroptera jacksoni (SHARPE, 1896), **comb. nov.**

Kallima jacksoni SHARPE, 1896.

4. *Rumia* is excluded from *Kallima* and the new genus is erected for it as follows:

***Kallimoides* SHIRÔZU et NAKANISHI, gen. nov.**

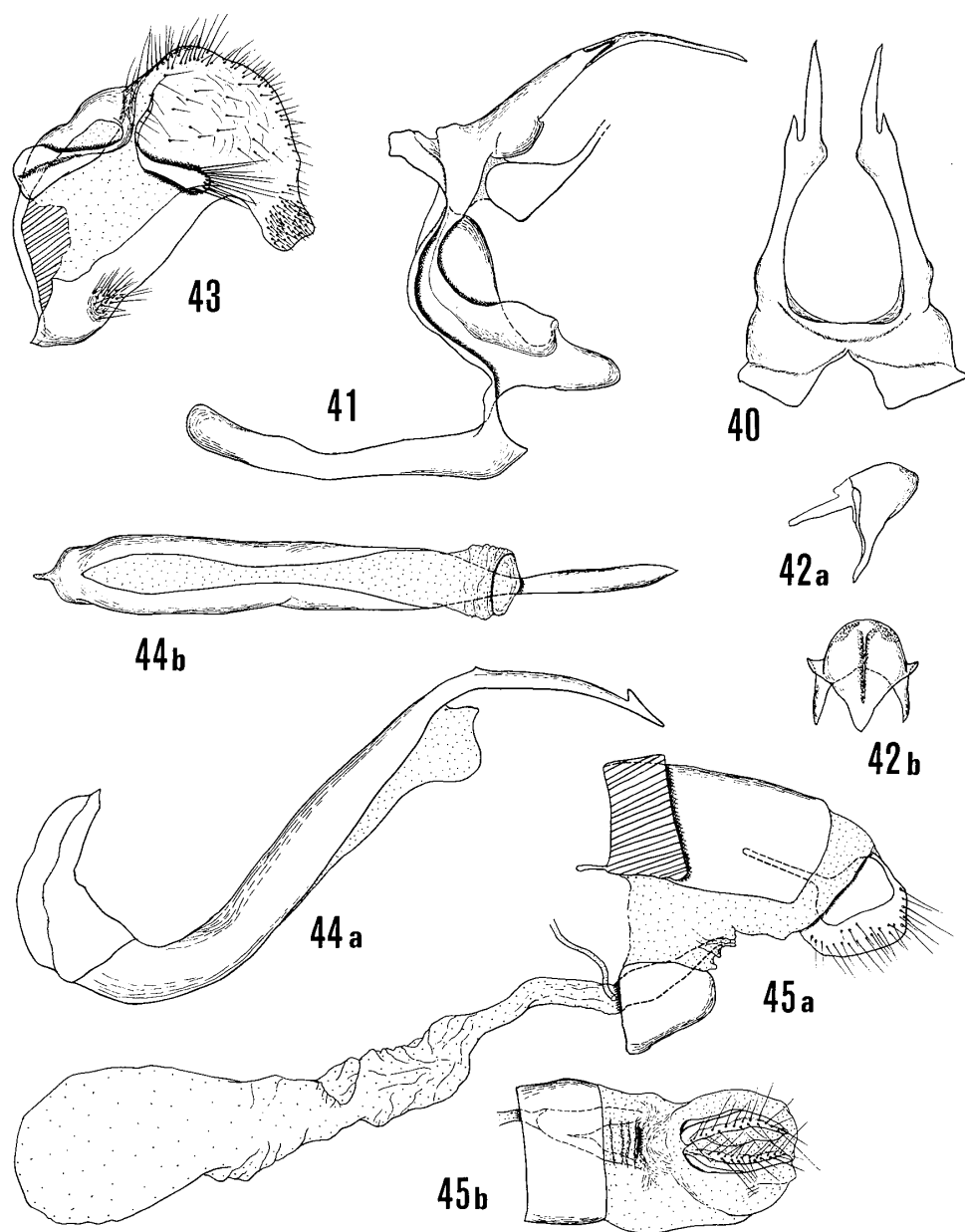
Type-species, *Kallima rumia* (DOUBLEDAY, 1849)

Wing venation (Fig. 5). R1 and R2 originating before and near the cell end; R1 conglutinating with Sc on its subbasal 2/5 and with R2 on its subapical 1/4; R3 originating at about basal 1/3 of the vein between upper angle of the cell and origin of R4; lower discocellular vein of fore wing obsolete leaving anterior and posterior rudiments; lower discocellular vein of hind wing absent.

Male external genitalia (Figs. 40–44). Dorsum composed of extremely reduced tegumen and a pair of long and narrow uncus projections, the former warped basally with a deep and broad incision medially, the latter arising from the distal corners of the tegumen and extending posterodorsally and weakly downcurved at apical 2/5, each projection ending in a very sharp apex with a subapical short and sharp tooth; dorsum thin and becoming thinner toward apex in lateral view. Tegumen and vinculum completely fused with each other and being indiscernible. Ring with very narrow reflected flange; posterior margin of ring expanding backwards, especially so on the ventral portion; saccus very long, nearly as long as height of ring. Gnathos divided into a pair of small sclerites, its distal portion extending posterodorsally to the costa of valva and completely fused with it. Juxta being a sclerotized semioval pad-like structure, of which anteroventral margin is narrowly produced between bases of sacculi, and lateral portion is weakly expanded, then projects anteriorly a long narrow band on manica. Valva rather small, evenly broad with ventrodistal portion expanding ventrad as a flat and broad lobe with truncate apex; inner surface mostly membranous leaving narrow costal and saccular+harpal regions, a short membranous projection arising at the base of ampullar region. Phallus huge, elongated S-shape in lateral view with its distal 1/4 slender and hook-shaped; ventral side of aedeagus membranous for almost throughout its length from the zone to distal 1/4 of aedeagus, at the posterior end of membrane vesica opens; subzonal sheath very short.

Female external genitalia (Fig. 45). Genital plate absent. Ostium bursae opening on the membrane behind 7th sternum. Sclerotized part of ductus bursae (antrum) short; corpus bursae narrow and elongated, without signum. Apophysis anterioris short. Apophysis posterioris long, about 0.4 × as long as 8th tergum.

Remarks. We are uncertain as to the belonging of this new genus to the subfamily Nymphalinae in the present time, because this genus has several characters that disagree



Figs. 40–45. Male and female external genitalia of *Kallimoides rumia* (DOUBLEDAY). 40: Dorsum in dorsal view. 41: Ring and gnathos in lateral view. 42: Juxta in lateral view (a) and in posterodorsal view (b). 43: Inside of right valva with gnathos. 44: Phallus in lateral view (a) and in ventral view (b). 45: Female external genitalia in lateral view (a) and in ventral view (b).

with generally accepted characteristics of the subfamily Nymphalinae, i.e. the extraordinarily reduced scaphium, the peculiar phallus, the absence of genital plate and the partial conglutination of R1 with Sc and R2. Moreover we could not find out any close relatives of this new genus not only in the subfamily Nymphalinae but also in the family Nymphalidae. It is needed to get knowledge of the early stages to clarify the systematic position of this genus within the family Nymphalidae.

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References

- AURIVILLIUS, C., 1913. Genus *Kallima* WESTWOOD. In SEITZ, A. (ed.), *Macrolepidoptera of the World*, 13: 211–212. F. Lehmann, Stuttgart.
- BINGHAM, C. T., 1905. The fauna of British India, including Ceylon and Burma. Butterflies 1. 511 pp. Taylor and Francis, London.
- CARCASSON, R. H., 1981. Collins Handguide to the Butterflies of Africa. 188 pp. Collins, London.
- CORBET, A. S. & H. M. PENDLEBURY, 1978. The butterflies of the Malay Peninsula (3rd edition revised by ELIOT, J. N.). 578 pp. Malayan Nature Society, Kuala Lumpur.
- D'ABRERA, B., 1980. Butterflies of the Afrotropical Region. 193 pp. Lansdowne, Melbourne.
- EVANS, B. W. H., 1932. The Identification of Indian Butterflies (2nd ed.). 454 pp. Bombay Natural History Society, Madras.
- FRUHSTORFER, H., 1912. Genus *Kallima* DOUBLEDAY. In SEITZ, A. (ed.), *Macrolepidoptera of the World*, 9: 564–567. F. Lehmann, Stuttgart.
- HEMMING, F., 1967. The generic names of the butterflies and their type-species (Lepidoptera: Rhopalocera). *Bull. Br. Mus. nat. Hist. (Ent.)*, Suppl., 9: 1–509.
- DE LESSE, H., 1952. Note sur les genres *Precis* HÜBNER et *Junonia* HÜBNER (Lep. Nymphalidae). *Bull. Soc. ent. Fr.*, 57: 74–77.
- MORISHITA, K., 1977. *Kallima inachus* & its allies. *Yadoriga*, (89–90): 3–16. (In Japanese.)
- MARSHALL, G. F. L. & L. DE NICÉVILLE, 1886. The Butterflies of India, Burma and Ceylon, 2. 332 pp. Calcutta Press, Calcutta.
- ROEPKE, W., 1938. Rhopalocera Javanica, III, Family Nymphalidae: 235–362. Veenman & Zonem, Wageningen.
- SCUDDER, S. H., 1875. Historical sketch of the generic names proposed for butterflies. *Proc. Am. Acad. Arts & Sci.*, 10: 91–293.
- SHIRÔZU, T., 1960. Butterflies of Formosa in Colour. 481 pp. Hoikusha, Osaka. (In Japanese.)
- VAN SON, G., 1979. The Butterflies of Southern Africa, Part IV Nymphalidae: Nymphalinae. Revised and edited by L. VÁRI. *Transvaal Museum Memoir*, 22: 1–286.

摘 要

コノハチョウ属 *Kallima* の再検討 I. 属の分類 (白水 隆・中西明德)

コノハチョウ属 *Kallima* の全種 (アジア産 7 種, アフリカ産 4 種) の翅脈相, 雌雄外部生殖器の比較形態学的研究を行い, 本属に分類学的再検討を加えた. その結果, 従来受け入れられてきた本属の分類体系は種レベルのみならず, 属レベルにおいても多くの問題を含んでいることが明らかになった. 本報文では属レベルの分類学的再検討の結果を報告した. その概要は次の通りである.

1. “*Kallima*” 属は多系統的であり, 属レベルで異なる 4 群を含んでいる.
2. アジアの種群は固有の新形質, ① gnathos は 1 対の細い帯状の骨片となり manica 上を体前方向に長く伸長する, ② juxta の背面部より後方に長く伸びる 1 対の遊離突起が生じる, ③ uncus 先端は深く 2 又する (*horsfieldi* では uncus 先端部は中央部の長い膜質のスリットにより左右の骨片に分離されている. この状態は単純なクチバシ状の uncus から深く 2 又した uncus への移行型と考えられる), を持っており, これらは単系統群 (属) としてまとめられる. *Kallima* の模式種 *paralekta* がこの群に含まれるためアジアの種に *Kallima* が適用される.
3. 種 *ansorgei* と *cymodoce* は, ① gnathos-juxta-sacculus が部分的に融合し, 複雑な複合構造を作る, ② 良く発達した cochlear を備える, ③ harpe の後縁は幅広く深くえぐられる, という新形質を持っている. これらの新形質は *Junonia* 属の固有新形質と考えられるものであり, 両種が *Junonia* に属することは疑いもない. 種 *ansorgei* と *cymodoce* は *Junonia* 属に移された.
4. 種 *jacksoni* は, ① uncus に良く発達した fenestrula を備える, ② gnathos 腹端に微小な針状突起を多数生じる, ③ phallus の suprazonal sheath の骨化は非相称的であり, perivesical area は左側に位置する, という 3 つの新形質を持っている. これらの新形質は本種以外ではタテハチョウ亜科の, アフリカ特産で 1 属 1 種のチョウとして知られる *Catacroptera cloanthe* に見出された. 種 *jacksoni* と *cloanthe* はこれら 3 新形質を固有新形質とする単系統群 (*Catacroptera* 属) を構成すると考えられ, *jacksoni* を同属に移した.
5. 種 *rumia* は翅脈相, 雌雄外部生殖器のいずれにおいても他の種と大きく異っていた. 特に雄外部生殖器は特異で, 類似の構造を持った種はタテハチョウ科の中には知られていないと思われた. 本種を模式種として新属 *Kallimoides* を創設した. 現時点では本種のタテハチョウ科における系統的 position は不明である. 将来の研究に待ちたいが, 特に幼生期の解明が期待される.